

# Mapping disks around protostars

It is well-established that extremely young solar-type stars produce powerful X-ray flares. Protostars typically show  $L_x \simeq 10^{29} - 10^{30}$  erg/s in the 2 – 8 keV band with very high absorption<sup>1,2</sup>. The flares arise from violent magnetic reconnection events, but the location of the flaring field lines is uncertain<sup>3</sup>: Near the stellar surface? Connecting the star to the disk? Over the disk?

In two cases, R1 in the Corona Australis cloud<sup>4</sup> and YLW 16A in the Ophiuchus cloud<sup>1</sup>, a 6.4 keV line was seen during a flare, most likely arising from X-ray reflection off of the protoplanetary disk. A detailed study of time delays between the flare and reflection components should permit geometric modeling of the protostellar system<sup>1,5</sup>, as has been achieved for Seyfert galaxies<sup>6</sup>. X-ray reverberation mapping could give unique insight into the structure and evolution of protoplanetary disks, and thus into the origin of planetary systems. The full potential of this science cannot be accomplished with Chandra or XMM: the high throughput of Con-X is needed.

<sup>1</sup> Imanishi, Koyama & Tsuboi, 2001, ApJ 557, 747

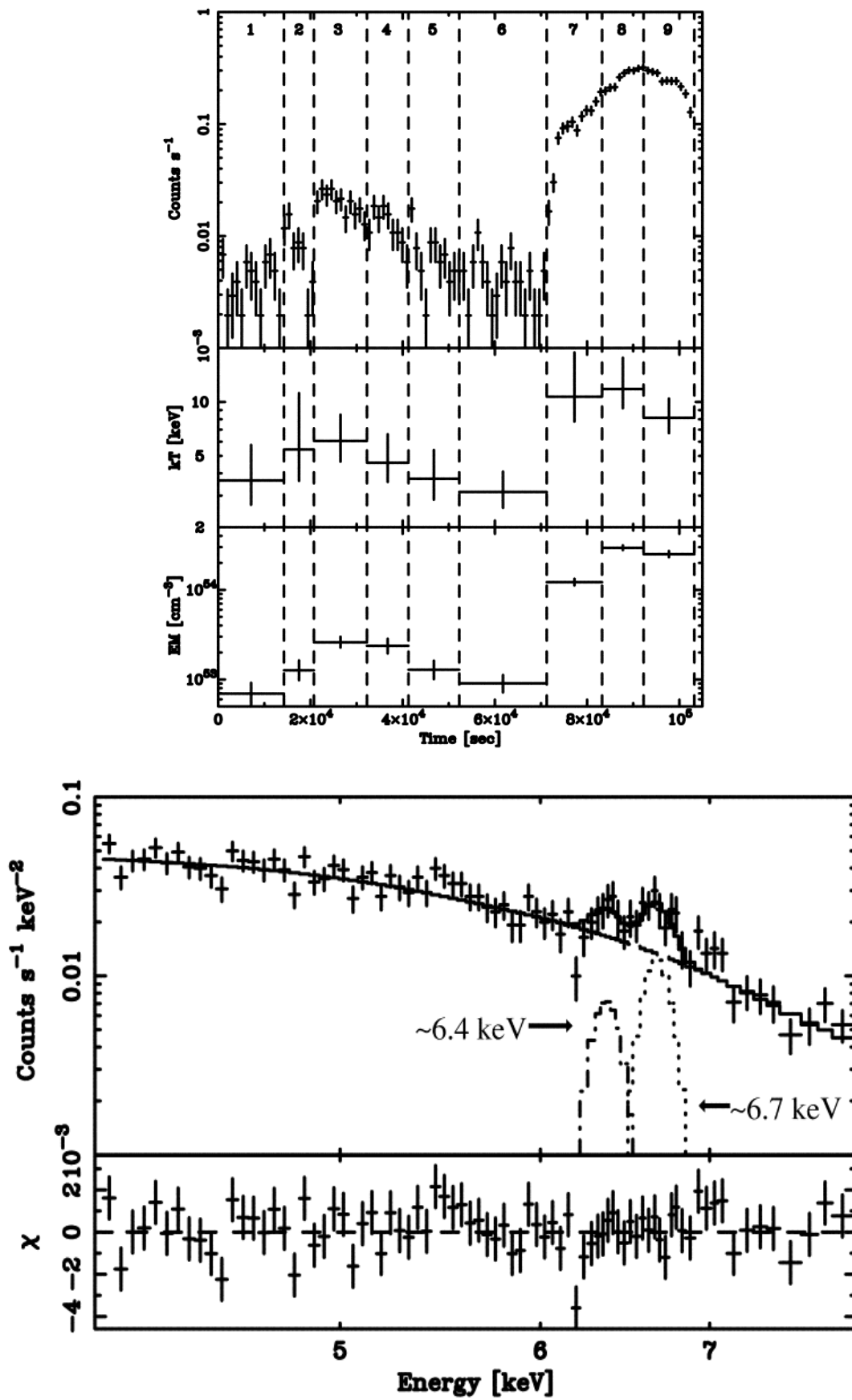
<sup>2</sup> Getman et al., 2002, in preparation

<sup>3</sup> Feigelson & Montmerle, 1999, ARAA 37, 363

<sup>4</sup> Koyama et al, 1996, PASJ 48, L87

<sup>5</sup> Feigelson, Pravdo & Garmire, 2001, submitted; Phys Today 11/01

<sup>6</sup> Nayakshin & Kallman, 2001, 546, 406



Flare light curve and spectrum from Class I protostar YLW 16A, observed with Chandra ACIS (Imanishi et al. 2001)